Transmittal Letter to the United States Designated/Elected Office (DO/EO/US)

09/914344
JC14 Rec'd PCT/PTO 24 AUG 2001

Docket No. : **HM-427PCT**
U.S. Application No. :
International Application No. : **PCT/EP00/00808**
International Filing Date. : **February 1, 2000**
Priority Dates Claimed : **February 26, 1999**
Title of Invention : **COMPACT BLAST FURNACE INSTALLATION**
Applicant(s) for (DO/EO/US) : **Franz Reufer, Wilhelm Müller, Thomas Kaluza and Rainer Beermann**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. X This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. ___ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. X This express request to begin national examination procedures 35 U.S.C. 371 (f) at any time rather than delay examination until the expiration of the applicable time limit set forth in 35 U.S.C 371(b) and PCT Articles 22 and 39(1).
4. ___ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. X A copy of the International Application as filed [35 U.S.C. 371(c)(2)],
   a) X is transmitted herewith (required only if not transmitted by the International Bureau).
   b) ___ has been transmitted by the international Bureau.
   c) ___ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. X A translation of the International Application into English [35 U.S.C.371(c)(2)].
7. ___ Amendments to the claims of the International Application under PCT Article 19 [35 U.S.C.371(c)(3)]
   a) ___ are transmitted herewith (required only if not transmitted by the International Bureau).
   b) ___ have been transmitted by the International Bureau.
   c) ___ have not been made; however, the time limit for making such amendments has NOT expired.
   d) ___ have not been made and will not be made.
8. ___ A translation of the amendments to the claims under PCT Article 19 [35 U.S C.371(c)(3)].
9. X An oath or declaration of the inventor(s) [35 U.S.C.371(c)(4)].
10. ___ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 [35 U.S.C.371(c)(5)].

Items 11. to 16. below concern other document(s) or information included:

11. X An Information Disclosure Statement under 37 C.F.R. 1.97 and 198.
12. ___ An Assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. X A FIRST preliminary amendment.
    ___ A SECOND or SUBSEQUENT preliminary amendment.
14. ___ A substitute specification.
15. ___ A change of power of attorney and/or address letter.
16. X (other items or information) Four sheets of drawings, PTO-1449 w/ 6 references and International Search Report

EXPRESS MAIL No.: EL 803 956 389 US Deposited: August 24, 2001

I hereby certify that this correspondence is being deposited with the United States Postal Service Express mail under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, DC 20231.

Friedrich Kueffner — August 24, 2001
Date

JC03 Rec'd PCT/PTO 24 AUG 2001

17. X The following fees are submitted:

	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE [37 CFR 1.492(a)(1)-(5)]:		
X Search Report has been prepared by the EPO or JPO..... $ 860.00		
___ International preliminary examination fee paid to USPTO [37 CFR 1.482]:..... $ 690.00		
___ No International preliminary examination fee paid to USPTO [37 CFR 1.482] but International search fee paid to USPTO [37CFR 1.445(a)(2):..... $ 710.00		
___ Neither International preliminary examination fee [37 CFR 1.482] nor International search fee [37 CFR 1.445(a)(2)]) paid to USPTO:..... $ 1000.00		
___ International preliminary examination fee paid to USPTO [37 CFR 1.482] and all claims satisfied provisions of PCT Article 33 (2) to (4):..... $ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT:	$ 860.00	
Surcharge of $ 130.00 for furnishing the oath or declaration later than ___20 ___30 months from the earliest claimed priority date [37 CFR 1.492(e)]	$	
Claims filed Extra Rate		
Total Claims 8 -20= x $ 18.=	$	
Indep. Claims 1 - 3= x $ 80.=	$	
Multiple Dependent Claims (if applicable) + $ 270.=	$	
TOTAL OF ABOVE CALCULATIONS:	$ 860.00	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity Statement must be filed also. [Note 37 CFR 1.9,1.27, 1.28] (divided by 2)		
SUBTOTAL:	$ 860.00	
Processing fee of $ 130.00 for furnishing the English translation later than ___20 ___30 months from the earliest claimed priority date [37 CFR 1.492(f)]	$	
TOTAL NATIONAL FEE:	$ 860.00	
Fee for recording the enclosed assignment [37 CFR 1.21(h)] The assignment must be accompanied by an appropriate cover sheet [37 CFR 3.28,3.31]. **$ 40.00 per property**	$	
TOTAL FEES ENCLOSED:	$ 860.00	
AMOUNT TO BE REFUNDED:	Refunded	$
AMOUNT TO BE CHARGED:	Charged	$

a) X A check in the amount of **$ 860.00** to cover the above fees is enclosed.

b) _ Please charge my Deposit Account No. 11-1835 in the amount of $ to cover the above fees. A duplicate copy of this sheet is enclosed.

c) X The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **11-1835**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 36 CFR 1.494 or 1.495 has not been met, a petition to revive [37 CFR 1.137(a) or (b)] must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO: Friedrich Kueffner
342 Madison Avenue
Suite 1921
New York, NY 10173

Friedrich Kueffner
Name

signature

29,482
Reg. No.

August 24, 2001
Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

HM-427PCT

Applicant: Franz Reufer, et al

Serial No: not yet known (PCT/EP00/00808)

Int. Filed: February 1, 2000

For: COMPACT BLAST FURNACE INSTALLATION

Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

S I R:

In advance of the first office action, please amend the claims as follows:

IN THE CLAIMS

Replace current claims 1 - 8 by the enclosed amended claims 1 - 8. A marked-up version of amended claims 1 - 8 is also enclosed.

REMARKS

Claims 1 - 8 are in the application.

As a result of the foregoing amendment, the claims have been amended to remove improper multiple dependencies.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 11-1835.

Respectfully submitted,

Friedrich Kueffner Reg. No. 29,482
342 Madison Avenue
New York, NY 10173
(212) 986-3114

August 24, 2001
FK:ml
ENCLS:
Amended Claims;
Marked-Up Version.

EXPRESS MAIL No.: **EL 803 956 389 US** Deposited: **August 24, 2001**

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Friedrich Kueffner

CLEAN VERSION OF AMENDED CLAIMS

1. Blast furnace installation with a blast furnace in a shaft furnace configuration and of a free-standing construction without frame as well as correlated installation parts such as hot blast generating device, burdening, and pouring bay, for continuous smelting of at least partially treated iron ore to hot metal, wherein the blast furnace (10) with a frame diameter of between 5 and 10 m is of a compact configuration with the features

(a) a self-supporting blast furnace armor construction wherein the entire upper blast furnace construction of the blast furnace (10) - with a top closing device (14) configured as a revolving chute with a fixedly installed slant angle without tilting mechanism, gas removal pipe (15), and safety valves (16) including pressure compensation - is supported on the blast furnace armor (12);

b) in the frame area, in the zones of belly of the blast furnace, waist of the blast furnace, and lower shaft, water-cooled cooling elements of a material having high thermal conductivity are arranged between the refractory furnace wall (11) and the blast furnace armor (12);

c) for tapping of the hot metal only one tap hole (18) is installed on the furnace (10) with only one set of tap hole plugging and drilling machines.

2. Blast furnace installation according to claim 1, wherein the top closing device (14) is in working connection with a radially movable throat armor (17).

3. Blast furnace installation according to claim 1, wherein directly adjacent to the blast furnace (10), at a spacing from the center axis of the blast furnace of approximately 25 to 35 m, a vertical conveyor (20) for conveying the raw materials (iron ore, reduction agents, additives) into the blast furnace is arranged and that directly adjacent to the vertical conveyor (20) the burdening (30) is arranged.

4. Blast furnace installation according to claim 3, wherein the burdening (30) is reduced to a working and material storage volume of preferably 3 to 4 hours.

5. Blast furnace installation according to claim 1, wherein the blast furnace (10) and the burdening (30) are connected to one another via the installed automation and control device.

6. Blast furnace installation according to claim 1, wherein the pouring bay (50) is configured and arranged directly adjacent to the blast furnace (10) such that by means of a gutter system (52) the crude iron is directly transported into correspondingly large ladles (51) and the slag is directly transported into a slag blanket (53) and/or into a slag granulation device (54).

7. Blast furnace installation according to claim 1, wherein the hot blast generating device (40) is operated preferably with only two hot blast apparatus (41).

8. Use of a blast furnace installation according to claim 1, wherein the compact blast furnace installation is used for producing hot metal in so-called mini mills (mini steel works with an annual capacity of approximately 0.5 to 2 million tons).

MARKED-UP VERSION OF AMENDED CLAIMS

1. Blast furnace installation with a blast furnace in a shaft furnace configuration and of a free-standing construction without frame as well as correlated installation parts such as hot blast generating device, burdening, and pouring bay, for continuous smelting of at least partially treated iron ore to hot metal, [characterized in that] <u>wherein</u> the blast furnace (10) with a frame diameter of between 5 and 10 m is of a compact configuration with the features

(a) a self-supporting blast furnace armor construction wherein the entire upper blast furnace construction of the blast furnace (10) - with a top closing device (14) configured as a revolving chute with a fixedly installed slant angle without tilting mechanism, gas removal pipe (15), and safety valves (16) including pressure compensation - is supported on the blast furnace armor (12);

b) in the frame area, in the zones of belly of the blast furnace, waist of the blast furnace, and lower shaft, water-cooled cooling elements of a material having high thermal conductivity are arranged between the refractory furnace wall (11) and the blast furnace armor (12);

c) for tapping of the hot metal only one tap hole (18) is installed on the furnace (10) with only one set of tap hole plugging and drilling machines.

2. Blast furnace installation according to claim 1, [characterized in that] wherein the top closing device (14) is in working connection with a radially movable throat armor (17).

3. Blast furnace installation according to [claim 1 or 2, characterized in that] claim 1, wherein directly adjacent to the blast furnace (10), at a spacing from the center axis of the blast furnace of approximately 25 to 35 m, a vertical conveyor (20) for conveying the raw materials (iron ore, reduction agents, additives) into the blast furnace is arranged and that directly adjacent to the vertical conveyor (20) the burdening (30) is arranged.

4. Blast furnace installation according to claim 3, [characterized in that] wherein the burdening (30) is reduced to a working and material storage volume of preferably 3 to 4 hours.

5. Blast furnace installation according to [one or several of the claims 1 to 4, characterized in that] claim 1, wherein the blast furnace (10) and the burdening (30) are connected to one another via the installed automation and control device.

6. Blast furnace installation according to [one or several of the claims 1 to 5, characterized in that] claim 1, wherein the pouring bay (50) is configured and arranged directly adjacent to the blast furnace (10) such that by means of a gutter system (52) the crude iron is directly transported into correspondingly large ladles (51) and the slag is directly transported into a slag blanket (53) and/or into a slag granulation device (54).

7. Blast furnace installation according to [one or several of the claims 1 to 6, characterized in that] claim 1, wherein the hot blast generating device (40) is operated preferably with only two hot blast apparatus (41).

8. Use of a blast furnace installation according to [one or several of the claims 1 to 8, characterized in that] claim 1, wherein the compact blast furnace installation is used for producing hot metal in so-called mini mills (mini steel works with an annual capacity of approximately 0.5 to 2 million tons).

4/PRTS

Translation of WO 00/52213 (PCT/EP00/00808) with Amended Claims Incorporated Therein

Compact Blast Furnace Installation

The invention relates to a blast furnace installation comprising a blast furnace of a shaft furnace construction and of a free-standing configuration without frame as well as correlated installation parts such as hot blast generating device, burdening, and pouring bay for continuous smelting of at least partially treated iron ore to hot metal.

Such blast furnaces without frame are known. For example, such blast furnaces without frame (American configuration) are described in "Hütte", Taschenbuch für Eisenhüttenleute, publishing house Wilhelm Ernst & Sohn, Berlin, 1961, on page 528, wherein the shaft is armored with a steel sheet mantle and is supported by means of a support ring on supports which are positioned closely adjacent to the blast furnace.

Modern blast furnace installation technology is based on the design and an installation arrangement which is based on the available technology and the logistic necessities for charging of the blast furnace with raw materials as well as for transporting the liquid products hot metal and slag.

The generally available technology results in a blast furnace which is provided with a blast furnace frame in order to free the furnace construction itself as much as possible from all loads. On this blast furnace frame, the entire upper furnace construction,

including top closing device, gas removal pipes, and safety valves inclusive of pressure compensation, is supported as well as the charging belt by which the raw materials are transported to the upper end of the blast furnace - the charging platform.

The blast furnace installation that is conventional today is configured, because of the large material conversion (ore, reduction agents, additives -> liquid slag, hot metal, furnace dust), so as to accommodate good transport possibilities, wherein the individual components of the installation are arranged on a correspondingly large surface area.

The blast furnace installation of known installations includes, in addition to the blast furnace, a burdening, which is connected with the blast furnace by a charging belt and, corresponding to the incline angle of the charging belt and the height of the blast furnace, approximately 55 to 65 m, is arranged approximately 300 m away from the blast furnace. Moreover, adjacent to the blast furnace a hot blast generating device is provided in which, by means of currently usually three hot blast apparatus, the required reaction gas (combustion air) is pre-heated as well as, furthermore, a dust removal and cleaning device for the blast furnace gas in the vicinity of the blast furnace. The frame armor of the blast furnace is cooled generally by means of conventional frame trickling apparatus.

In an unpublished German patent application (application No. 198 24 367.7) it has been suggested to replace the inclined elevator or the charging belt for the transport of the raw materials to the charging platform by a vertical elevator, and in a further

unpublished application (application No. 198 16 867.5) it has been recommended to manufacture the water-cooled cooling elements, arranged between the frame armor and the refractory blast furnace wall, of a material having high thermal conductivity in order to minimize the danger of break-out within the frame area during operation of the blast furnace.

Based on this known prior art, it is the object of the invention to develop for a blast furnace a new space-saving and cost-saving concept of a blast furnace installation by which the crude steel production is economical even for small throughput.

This object is solved for a blast furnace installation of the aforementioned kind with the characterizing features of claim 1. Advantageous embodiments of the invention are defined in the dependent claims.

With the measures of the invention, to configure the blast furnace in a compact configuration as well as to configure or arrange the arrangement of the most important installation parts belonging to the blast furnace in a compact way in direct vicinity of the blast furnace, a completely new design of a compact blast furnace installation is obtained. There is the possibility of installing a conventional frame trickling apparatus.

By employing cooling elements in the thermally highly loaded frame area of the blast furnace, which elements are manufactured of a material having high thermal conductivity, the blast furnace armor is optimally cooled in this area which is at risk for break-out. The danger of cooling failure with local overheating, in connection

with failure of the material strength, is therefore no longer present. This results directly in that the blast furnace armor is particularly loaded and the complex blast furnace frame that was required in the past can be eliminated in any case. Required working platforms can be fastened directly on the armor of the furnace. Also, the entire upper furnace construction with a top closing device, gas removal pipes, and the safety valves including pressure compensation are now supported on the blast furnace armor.

According to an advantageous configuration of the invention, in this connections the otherwise conventional complex top closing device is formed by a revolving chute of a simplified configuration wherein a tilting mechanism is eliminated and the slant angle of the revolving chute is fixedly adjusted once according to the furnace size. This has the advantage, in particular, in the case of smaller blast furnaces, that the top closing device drive (the revolving chute carrier) can be constructed in a much simpler way and the material distribution can be controlled with the radially movable throat armor that is present.

Moreover, the support of a charging belt on the blast furnace or on the blast furnace frame is no longer required with the configuration of the compact blast furnace according to the invention because the charging belt is replaced by a vertical conveyor which does not require any supporting action and which is arranged directly adjacent to the blast furnace. The spacing of the vertical conveyor is approximately 25 to 35 m away from the center axis of the blast furnace. This makes it possible to arrange the burdening directly adjacent thereto - it is conventional in known blast furnace installations to have a spacing

of the burdening housing from the blast furnace of approximately 300 m - so that a considerable savings in regard to the space requirement for the blast furnace arrangement according to the invention is obtained.

Also, the burdening itself is advantageously of a more compact design in that the working and material storage volume of 10 to 12 hours, conventional according to the prior art, is preferably reduced to 3 to 4 hours. This is sufficient for a safe consumption supply of the installation because the operation, as a result of the installed automation and control, is optimally monitored.

Since on the blast furnace only one tap hole aperture is installed (with only one set of tap hole plugging and drilling machines), it is now advantageously possible to design the pouring bay configuration much smaller (more compact) and thus in a more cost-beneficial way. The pouring bay, according to the invention, is arranged directly adjacent to the blast furnace and is configured such that the rail system for transporting the hot metal and liquid slag is no longer needed. By means of a gutter system the hot metal is transported into correspondingly large ladles and transported in a wheel-bound, while the liquid slag is transported into a slag blanket and/or into a slag granulation apparatus.

With the hot blast generating device installed according to the invention with preferably only two hot blast apparatus, there is the possibility to configure the blast furnace installation in an even more space-saving and more compact way. In this connection, the installed automation and control device than ensures that, for example, the blast furnace installation can be operated with an

annual production of approximately one million tons of hot metal in an optimal and extremely cost-beneficial way.

The construction of a compact blast furnace in connection with a compact burdening, a compact pouring bay (and its compact arrangement in direct vicinity of the blast furnace made possible by the use of the vertical conveyor) provides in this combination a technically totally new blast furnace installation which contributes considerably to the cost reduction of a modern steel making installation to be operated safely.

In particular, the compact blast furnace installation configured accordingly can be used for so-called mini mills. These are mini steel works with an annual capacity of approximately 0.5 to 2 million tons of crude steel. In such mini mills which are operated currently on the basis of direct reduction and/or melting of scrap metal by electric arc furnaces (EAF) and, as a result of their increased flexibility and economic benefits, have gained importance, a compact blast furnace device, as suggested by the invention, could be used advantageously.

Further details, features, and advantages of the invention will be explained in more detail in the following by means of the embodiments schematically illustrated in the drawings.

It is shown in:

Fig. 1 a side view of a part of a compact blast furnace installation;

Fig. 2 an enlarged detail view of the top part of the blast furnace according to Fig. 1;

Fig. 3 an enlarged detail view of the lower part of the blast furnace with pouring bay according to Fig. 1, rotated by 90°;

Fig. 4 a layout of a compact blast furnace installation in a schematic plan view.

In Figs. 1 and 2 a part of a compact blast furnace installation with blast furnace 10 is illustrated in a side view. Between the refractory furnace wall 11 and the blast furnace armor 12 water-cooled cooling elements (not illustrated) are arranged so that the blast furnace, frame which is conventionally used otherwise for reasons of operational safety, is no longer needed, for which reason the loads, which would have to be supported otherwise on this frame, is completely taken up by the supports 23, 24 (Fig. 2) and the support ring 22 of the blast furnace armor 12. These loads are the entire upper furnace constructions with the top closing device 14, gas removal pipe 15, safety valve 16, and movable throat armor (Fig. 2) as well as the upper end 21 of the vertical conveyor 20 which is arranged directly adjacent to the blast furnace 10 at a spacing from the center axis of the blast furnace within approximately 25 to 35 m therefrom. By using a vertical conveyor 20 instead of a charging belt for transporting the raw materials to the charging platform 13, it is possible to arrange the burdening 30 in immediate vicinity of the blast furnace 10.

In addition to the compact arrangement of the burdening 30 immediately adjacent to the blast furnace 10, the burdening is of a compact and space-saving and room-saving configuration because it must provide only a working and material storage volume of up to 3 to 4 hours. It is comprised, for example, of underground hoppers 31 that can be filled from above with the raw materials by means of trucks, wherein this raw materials can be removed again therefrom by means of conveyer belts 34 and can be filled by means of a vertical conveyor 33 for the burdening into the elevated hoppers 32. By means of removal belts 35 and the vertical conveyor 20 these raw materials are then transported to the charging platform 13 of the blast furnace 10.

Also in immediate vicinity of the blast furnace 10 and connected thereto by means of a gas removal pipe 15, a dust removal and cleaning device 25 for the blast furnace gas is provided from where a partial volume of the cleaned blast furnace gas is then guided by a pipeline 26 into the hot blast generating device 40 (Fig. 4).

In Fig. 2, the upper part of the blast furnace 10 is shown in an enlarged detail illustration. As a result of the larger scale, the upper furnace construction supported on the blast furnace armor 12 with the support ring 22 and the supports 23, 24 is shown better wherein which the upper end 21 of the vertical conveyor 20, the gas removal pipe 15 as well as the safety valve 16 are safely supported thereon. Moreover, in Fig. 2 the top closing device 14, which in the illustrated embodiment is a bell-type top, as well as the movable throat armor 17 are more clearly illustrated.

In Fig. 3 there is illustrated, also on a scale slightly larger than that of Fig. 1, the lower part of the blast furnace 10. It shows schematically the tap hole 18 and the pouring bay 50 with the gutter system 52 via which the hot metal flows with natural gradient into the wheel-bound pouring ladles 51. Above the gutter system 52, a removal hood 57 is provided which is connected to a dust removal device 56 (Fig. 4) so that rising vapors curing tapping can be collected and disposed of in an environmentally safe way.

Fig. 4 shows the layout of the compact blast furnace installation according to the invention with its most important installation parts. The core of the installation is the blast furnace 10 about which the most important further installation parts for the operation of the blast furnace are positioned with a spacing as minimal as possible. As already described in connection with Fig. 1, in immediate vicinity of the blast furnace the burdening 30 with the underground hoppers 31 and the elevated hoppers 32, from which the blast furnace 10 is charged with the required raw materials via the vertical conveyor 20, are located.

The pouring bay 50 with the gutter system 52 is arranged also in direct vicinity of the blast furnace 10 via which the produced hot metal is transported into the pouring ladles 51 (Fig. 3) and the slag into the slag blanket 53 and/or into the slag granulation device 54. A water treatment plant 55 for providing the granulation water is arranged adjacent to the slag granulation device 54. The dust removal device 56 arranged adjacent to the pouring bay 50 is connected with the pouring bay 50 and the burdening 30 and provides

during operation of the blast furnace 10 a proper dust removal of the pouring bay 50 and of the burdening 30.

The required hot blast for the operation of the blast furnace 10, which is introduced via the tuyeres 42 (Fig. 1) into the lower part of the blast furnace, is generated in hot blast generating device 40, also arranged in the vicinity of the hot blast furnace, in preferably two hot blast apparatus 41. The thermal energy which is required for operation of the hot blast generating device 40 is partially provided by the blast furnace gas which has been subjected to dust removal and cleaning. For this purpose, the blast furnace gas, which has been cleaned in the dust removal and cleaning device 25 for the blast furnace gas, is made available via a pipeline 26 to the hot blast generating device 40.

A further component of the compact blast furnace device according to the invention is finally a control room 60 from where, by means of the installed automation and control device, the operation of the blast furnace is monitored and controlled.

The embodiments of the compact blast furnace device illustrated in the drawings, in particular, the arrangement of the installation parts in the layout of Fig. 4, are only possible embodiments of the invention. They can be correspondingly modified, of course, according to the requirements and the specific local conditions when the features of the invention as they are formulated, in particular, in claim 1 are complied with.

Claims

1. Blast furnace installation with a blast furnace in a shaft furnace configuration and of a free-standing construction without frame as well as correlated installation parts such as hot blast generating device, burdening, and pouring bay, for continuous smelting of at least partially treated iron ore to hot metal, characterized in that the blast furnace (10) with a frame diameter of between 5 and 10 m is of a compact configuration with the features

(a) a self-supporting blast furnace armor construction wherein the entire upper blast furnace construction of the blast furnace (10) - with a top closing device (14) configured as a revolving chute with a fixedly installed slant angle without tilting mechanism, gas removal pipe (15), and safety valves (16) including pressure compensation - is supported on the blast furnace armor (12);

b) in the frame area, in the zones of belly of the blast furnace, waist of the blast furnace, and lower shaft, water-cooled cooling elements of a material having high thermal conductivity are arranged between the refractory furnace wall (11) and the blast furnace armor (12);

c) for tapping of the hot metal only one tap hole (18) is installed on the furnace (10) with only one set of tap hole plugging and drilling machines.

2. Blast furnace installation according to claim 1, characterized in that the top closing device (14) is in working connection with a radially movable throat armor (17).

3. Blast furnace installation according to claim 1 or 2, characterized in that directly adjacent to the blast furnace (10), at a spacing from the center axis of the blast furnace of approximately 25 to 35 m, a vertical conveyor (20) for conveying the raw materials (iron ore, reduction agents, additives) into the blast furnace is arranged and that directly adjacent to the vertical conveyor (20) the burdening (30) is arranged.

4. Blast furnace installation according to claim 3, characterized in that the burdening (30) is reduced to a working and material storage volume of preferably 3 to 4 hours.

5. Blast furnace installation according to one or several of the claims 1 to 4, characterized in that the blast furnace (10) and the burdening (30) are connected to one another via the installed automation and control device.

6. Blast furnace installation according to one or several of the claims 1 to 5, characterized in that the pouring bay (50) is configured and arranged directly adjacent to the blast furnace (10) such that by means of a gutter system (52) the crude iron is directly transported into correspondingly large ladles (51) and the slag is directly transported into a slag blanket (53) and/or into a slag granulation device (54).

7. Blast furnace installation according to one or several of the claims 1 to 6, characterized in that the hot blast generating device (40) is operated preferably with only two hot blast apparatus (41).

8. Use of a blast furnace installation according to one or several of the claims 1 to 8, characterized in that the compact blast furnace installation is used for producing hot metal in so-called mini mills (mini steel works with an annual capacity of approximately 0.5 to 2 million tons).

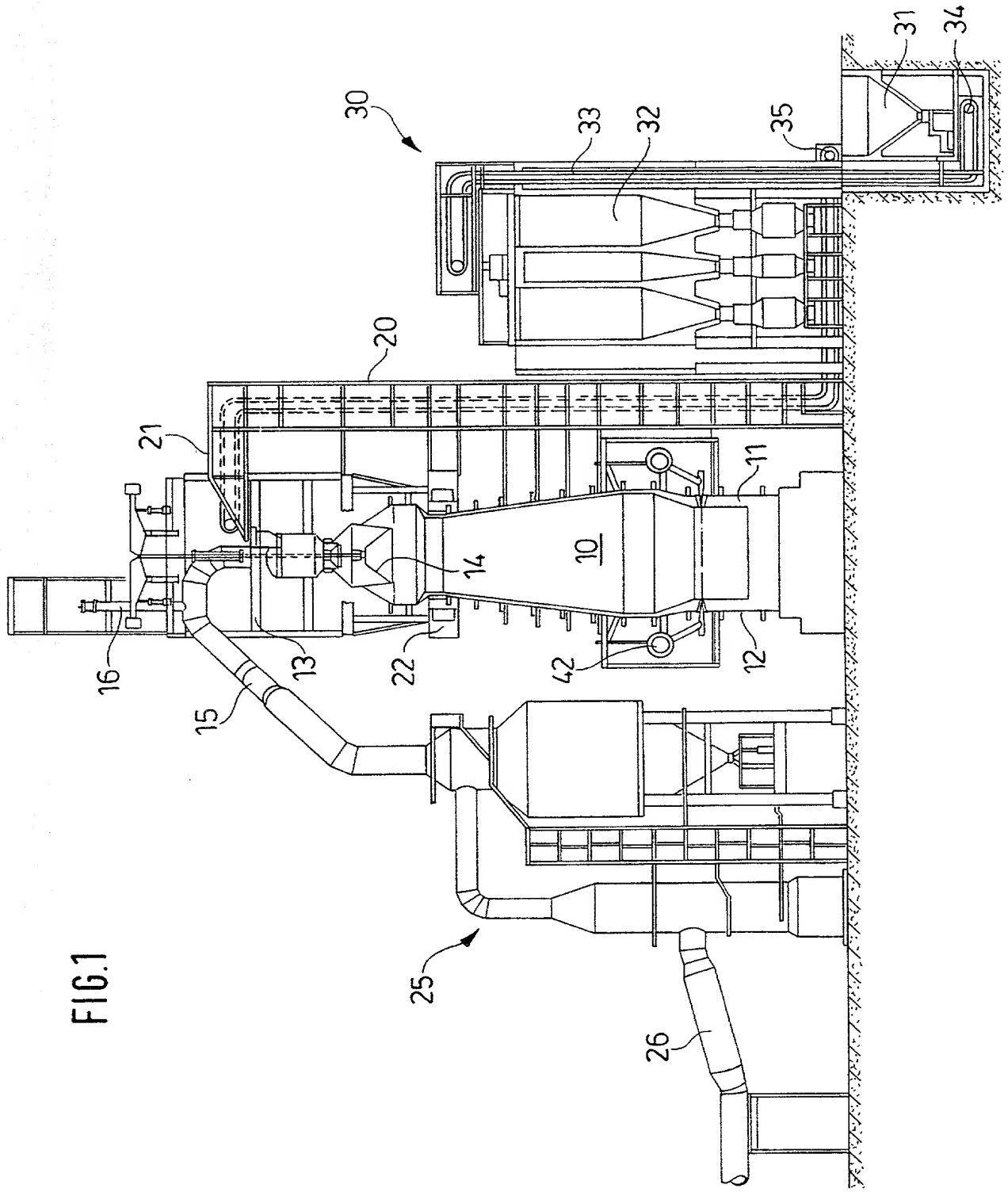


FIG.1

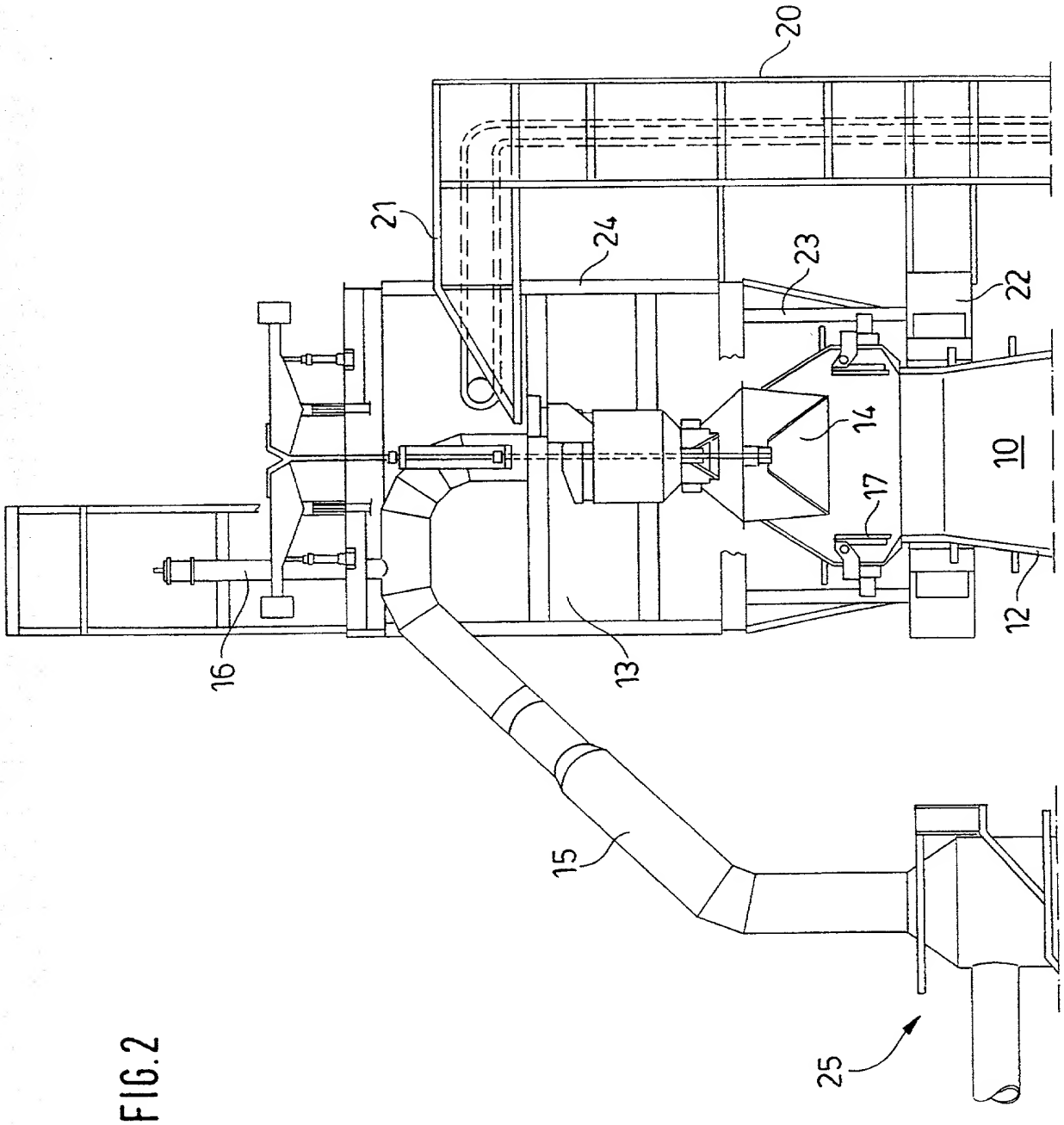


FIG.2

FIG.3

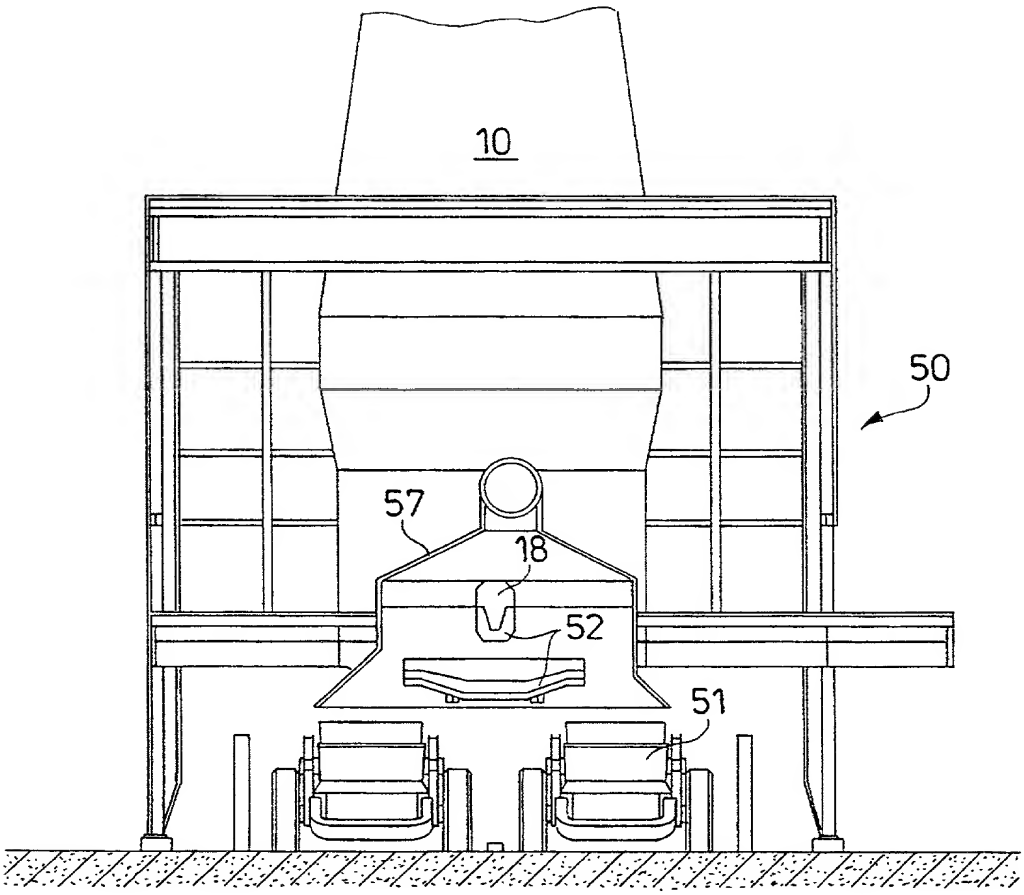
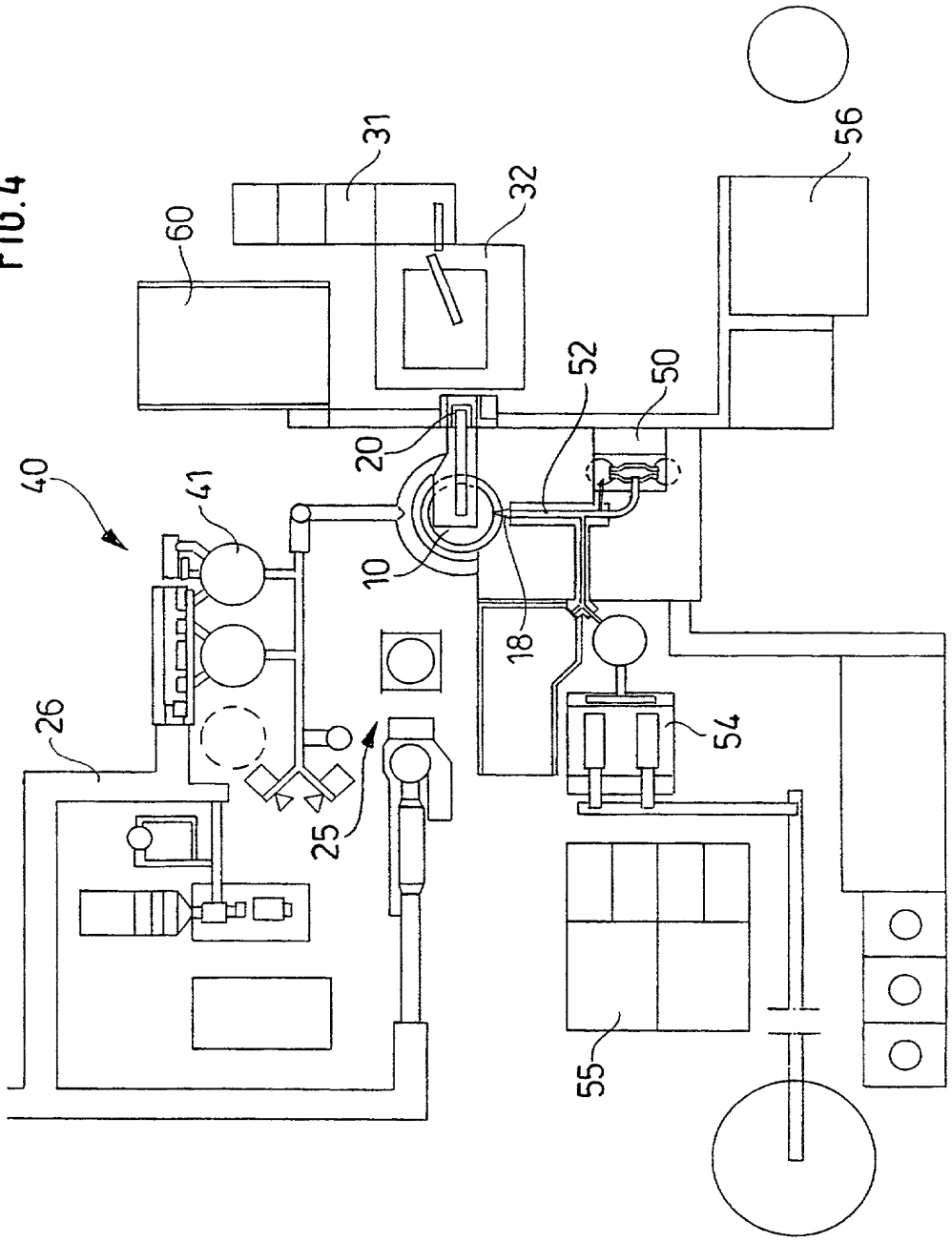


FIG.4



39627

COMBINED DECLARATION FOR PARENT APPLICATION AND POWER OF ATTORNEY *(includes Reference to PCT International Applications)*	Attorney's Docket No. **HM-427**

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **COMPACT BLAST FURNACE INSTALLATION**

the specification of which (check only one item below):

[ ] is attached hereto.

[ ] was filed as United States application

Serial No. _____
on _____,
and was amended
on _____ (if applicable).

[X] was filed as PCT international application
EP00/00808
Number **PCT/EP99/00808**
on **February 1, 2000**,
and was amended under PCT Article 19
on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY *(if PCT, indicate PCT)*	APPLICATION NUMBER	DATE OF FILING *(day, month, year)*	PRIORITY CLAIMED UNDER 35 USC 119
GERMANY	**199 08 709.1**	**26 February 2000**	[X] YES [ ] NO
			[ ] YES [ ] NO

Combined Declaration For Parent Application and Power of Attorney (Continued)
(includes Reference to PCT International Applications)

Docket No. **HM-427**

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of the application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty of disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application(s) and the national or PCT internation filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		**STATUS (CHECK ONE)**		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO.	PCT FILING DATE	U.S. SERIAL NO.			

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(List name and registration number)*

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PTO-1391 (REV. 10-83) U.S. DEPARTMENT OF COMMERCE - Patent and Trademark Office

Combined Declaration For Parent Application and Power of Attorney (Continued) *(includes Reference to PCT International Applications)*				Docket No. HM-427
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Combined Declaration For Parent Application and Power of Attorney (Continued) *(includes Reference to PCT International Applications)*	Docket No. **HM-427**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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	W. Müller	Thomas Kalugin
DATE 22.02.02	*DATE* 15.2.2001	*DATE* 9.1.2002

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